Simple
Echo Chamber

By **PETER F. BRETHERICK**

ONE OF THE MODERN EFFECTS USED BY RECORDING organisations is the addition of echo, and it plays a major part in the recording of "pop" records today. The echo effect is introduced by the use of what is called an "echo chamber" and, although its name implies that it is a large hollow container, it can in practice be a small electric device which is sometimes no bigger than a shoe-box.

It may be thought by the reader that the echo effect would require either a colossal concrete funnel or a complex tape mechanism which would be too complicated and too expensive for the average constructor. The unit about to be described has none of these disadvantages. It can be employed with almost any type of microphone or electric guitar and quite amusing results can be obtained when it is used with a radio tuner.

Basically, the unit consists of a high gain amplifier with a power output of some 3 to 4 watts (which is in excess of that necessary), together with an echo coil and a pick-up. The amplifier drives a small loudspeaker to which the echo coil is coupled. The audio signal from the loudspeaker travels down the coil and, after a delay in time, reaches the other end where it is detected by the pick-up and fed, together with the normal signal from the output of the echo amplifier, to the main amplifier. Thus, the main amplifier which, in the case of a guitar, would be the guitar amplifier, receives the normal signal and the echo signal via one lead. See Fig. 1.

The Echo Amplifier

The echo amplifier, the circuit of which is shown in Fig. 2, consists of a directly coupled triode-pentode valve, ECL82, fed from an EF86 high gain voltage amplifying pentode. Any other suitable amplifier could, of course, be used, provided that it has a high gain and adequate power output. It should be noted that excessive output power would result in distortion from the small speaker employed, and would also tend to make the echo coil jump about somewhat.

The amplifier is designed primarily for simplicity and low hum level. Consequently, all component values are critical and all input connections must be screened. The h.t. supply must be provided by a double-wound mains transformer as, quite apart from safety reasons, the unit will be used in conjunction with a high power amplifier whose chassis is almost sure to be earthed. The 10-watt resistor, R_9, should be kept reasonably clear of the other components due to its dissipated heat which, although not excessive, is quite considerable. The layout is not critical, except that all leads should be as short as possible and heater leads tightly twisted and kept close to the chassis. An 18 s.w.g. aluminium chassis approximately 8 x 6 x 2½in will be found suitable.

The circuit should need little explanation, the only unusual thing being the relatively low values of the coupling capacitor C_3, and the bass cut capacitor, C_1, in the guitar input channel. The aim of both these components is to cut the bass frequencies as much as possible, in order to compensate for the loss of treble in the echo coil.[1]

The Echo Coil

Initially, the reader may have visions of this coil consisting of yards of wire draped all around the room. However, if it is wound carefully and suspended properly, it should stretch out to no more than 24 inches.

[1] C_6, in conjunction with VR_3, forms a bass boost control. Whilst it may seem rather surprising to boost the bass after it has been cut, the circuit is, in practice, more straightforward than other forms of tone control.

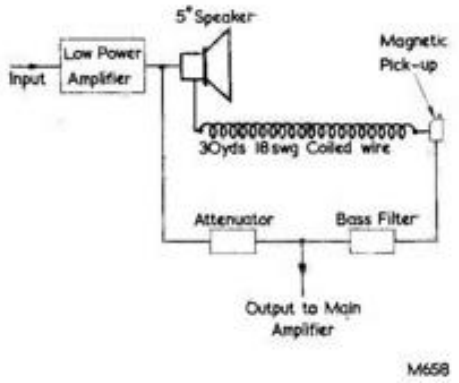

Fig. 1. The basic principles of the echo unit

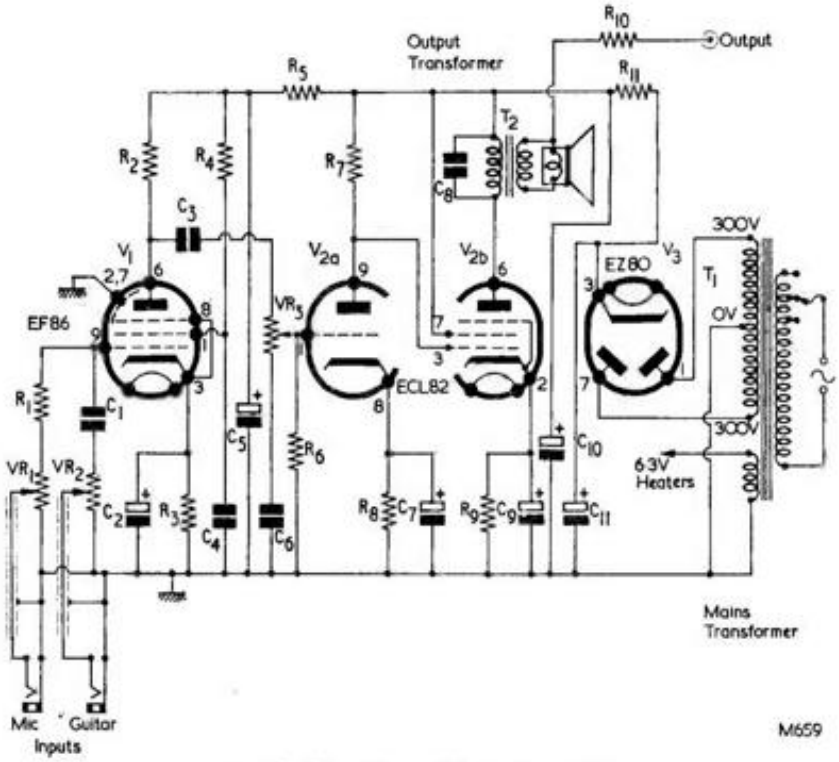

Fig. 2. The circuit of the echo amplifier

Components List
(Fig. 2)

Resistors

R_1	100kΩ ¼ watt 20%
R_2	100kΩ ¼ watt, Hi-Stab
R_3	2.2kΩ ¼ watt, Hi-Stab
R_4	390kΩ ¼ watt, Hi-Stab
R_5	100kΩ ¼ watt, 20%
R_6	1MΩ ¼ watt, 20%
R_7	470kΩ ¼ watt, 20%
R_8	2.2kΩ ¼ watt, 5%
R_9	2.7kΩ 10 watt, 5%
R_{10}	1MΩ ¼ watt, 20%
R_{11}	470Ω 1 watt, 20%
VR_1	1MΩ log
VR_2	1MΩ log
VR_3	1MΩ log

Capacitors

C_1	0.005μF, 350 w.v.
C_2	50μF, electrolytic, 12 w.v.
C_3	0.01μF, 350 w.v.
C_4	0.25μF, 350 w.v.
C_5	16μF, electrolytic, 350 w.v.
C_6	400pF, 350 w.v.
C_7	50μF, electrolytic, 12 w.v.
C_8	0.01μF, 350 w.v.
C_9	16μF, electrolytic, 150 w.v.
C_{10}	32μF, electrolytic, 350 w.v.
C_{11}	32μF, electrolytic, 350 w.v.

Valves

V_1	EF86
V_2	ECL82
V_3	EZ80 or EZ81

Miscellaneous

T_1	Primary to suit mains voltage. Sec: 300–0–300V 60mA, 6.3V 2A.
T_2	55:1 for 3Ω speaker
	B9A valveholders (3), chassis
	8 x 6 x 2½in, 5in speaker (see text)

18 s.w.g. galvanised iron wire was found to be the best and the cheapest material for the coil, and this is obtainable from most hardware merchants in 50-yard coils for a few pence. Copper wire, which would need only two-thirds the length to produce the same time-lag of echo, was found to be very flimsy and needed more support; it was also considerably more expensive.

The coil should be wound on a 1in diameter former, e.g. a broom-stick, using about 30 yards of the wire. It must be carefully wound, each turn touching its predecessor. When the finished coil, which should take about 30 minutes to wind, is carefully pulled off the former, it should stretch

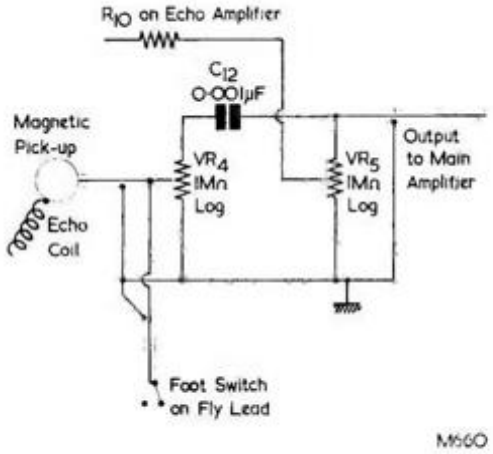

Fig. 3. The output mixing controls

Components List

(Fig. 3)

Potentiometers
VR_4 1MΩ Log
VR_5 1MΩ Log

Capacitor
C_{12} 0.001μF, 350 w.v.

Pick-Up
Magnetic (see text)

Switch
Foot-switch. Open when depressed

a maximum of 36 inches when held vertically and no turns should be touching. The 1in diameter former was used as it gave the best result for length and needed little support.

The Pick-Up

The most effective detection device was found to be a magnetic pick-up of the type found in old 78 r.p.m. record players and which are readily obtainable on the surplus market, if not already to hand. The end of the coil should neatly clamp in the needle socket in the pick-up.

A headphone could be used as a magnetic microphone, having its diaphragm drilled and the end of the coil pushed through and bent over. The only drawback to this is that acoustic feedback occurs if the volume is turned too high. There is, of course, no reason why a crystal pick-up should not be used, provided the reader can devise a method of connecting the end of the coil to it. Whichever method is used, the impedance must be fairly high; if a low impedance pick-up is used, a matching transformer must be employed.

The Output Controls

Fig. 3 shows how the echo and the main signal are mixed. Tone compensation for the echo output is again provided by means of the 0.001μF capacitor. A foot switch is provided to turn the echo on or off, as required. Except, of course, for the pick-up, foot-switch and output lead, the components shown in Fig. 3 should be mounted on the same chassis as the amplifier. There should now be five controls on the amplifier, giving a wide variety of effects.[2]

Assembly

The choice of case is left to the constructor, but it was found that a cabinet 24 x 8 x 7in successfully housed everything. The amplifier and speaker should be mounted at one end of the cabinet and the pick-up at the other. The speaker should be chosen with care, for it must have a tough cone. The free end of the coil, i.e. the opposite end to the pick-up, should now be carefully pushed through the cone and bent in a right angle behind it. The coil should be supported where necessary by means of elastic held by drawing pins at the top and bottom of the cabinet. If the coil is too long for the cabinet it may be doubled back. See Fig. 4.

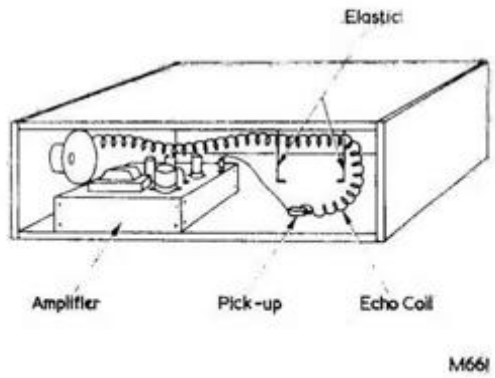

Fig. 4. Internal layout of the "echo chamber"

Finally

Should the echo produced be very distorted, the coil should be checked to see if any turns are touching or whether the coil touches the sides of the cabinet. If it is touched or gently flicked with the main amplifier switched on, a loud clang should result from the main amplifier. If this does not happen, check that the pick-up is working and that the associated connections are correct; also make sure that the foot switch is not in the closed position.

[2] It will be noted that, as with VR_1 and VR_2 of Fig. 2, the inputs to the potentiometers in Fig. 3 are applied to the sliders instead of across the tracks, as is more usual. This method of connection ensures that one level is not unduly affected by adjustments in the other potentiometer.